**Amendments to the Specification:**

Please amend the following paragraphs in the specification.

[0009] A method and apparatus are provided for adaptively controlling printer functions of a dot matrix printer in response to sensing the type of printer ink cartridge being used. An identifying resistive ~~valve~~ value is applied to surface of the cartridge and installed within the printer. The printer includes contacts that include sensors and sensor circuitry useful to detect a presence of the resistive indicator, and the resistive ~~valve~~ value thereof. The sensed resistive ~~valve~~ value is used to directly control printer functions, and/or to access stored data or printer control routines specific to the type of cartridge, or desired performance characteristics. Stored information, which may be appended by other sensed information such as printer usage data, is used to selectively regulate printer operation to achieve maximum efficiency and performance from the particular ink cartridge.

[0013] The resistive ink identifier may be formed in different ways, to provide different resistive ~~valves~~ values corresponding to operational parameters. In one embodiment the resistive ~~ind~~ ink identifier has a resistance ~~valve~~ value that is a function of its length. In other embodiments the resistive ~~valve~~ value of the ink identifier is a function of its width, or ink characteristics.

[0014] In the presently preferred embodiment print head impact force may be regulated, in response to sensed resistive ~~valves~~ values by varying the pulse width of the print head activation coil. As would be apparent to those with ordinary skill in the yard, various other methods may be used to regulate functions such as printer impact force, without departing from the broader aspects of the invention, as set forth below.

[0028] In order to distinguish between different ink ribbon cartridge models, it is cost efficient to use only one sensor or one sensor set, and still permit the usage of many different ribbon ink cartridge models. An electronic component, mounted upon the cartridge exterior services to identify and distinguish the cartridge model but manufacturing cartridges including such a component would be expensive. Besides the cost of the component itself, contact areas would also have to be installed. However, if the component were in the presently preferred embodiment, the electronic component or ~~idicia~~ indicia is implemented as a resistor, silk-screened directly on the cartridge exterior or onto a printed resistor label the resistance ~~valve~~ value is used to signify, for example, the cartridge model and ribbon

characteristics, such as ribbon type, length, ink density, etc. Where no resistor is sensed, for instance because an unclassified cartridge was installed, the cartridge would still function using default ~~valves~~ values not optimized ~~valves~~ values for printing. The silk-screened resistor could be silk-screened directly onto the cartridge at any convenient location. It could also be silk-screened onto a label that would be placed on the cartridge prior to shipment. The ability to add the resistor at any time would permit any cartridge presently in use to be classified and employed in connection with the present invention.

[0029] In the presently preferred embodiment of the present invention, the printer sensor is implemented by a simple pair of contacts which, when touching he silk-screened resistor, can be used to determine the resistance ~~valve~~ value of the resistor. The ~~valve~~ value of the silk-screened resistor is compared to a ~~valve~~ value stored in memory of the printing unit. The stored ~~valves~~ values are defined for known models and can also define extrapolated future models. The resistance ~~valve~~ value could be used to regulate printer striking force, specify the number of characters that can be printed from the ribbon (length/type of ribbon), the amount of ink density or remaining ink on the ribbon, etc. Different resistive ~~valves~~ values may be applied by varying the material used to fabricate the resistor, i.e. the use of different conductivity/resistivity materials. Alternatively, resistor paths lengths can be varied to produce different resistances while using the same conductivity materials. In another implementation different resistor ~~valves~~ values are obtained by varying the length to width ratio of the resistor materials, as such, one of ordinary skill will recognize that technique for applying resistive indicators of various resistor ~~valves~~ values, may vary, dependant upon cost, ~~ease~~ ease of application, etc. A color-coding scheme would also be provided, so that the customer could more easily distinguished between and select different capacities ~~fo~~ for the tape ribbon cartridge by the resistor color.

[0034] Figures 2a and 2b illustrate how the resistive ~~valve~~ value of the resistive ink identifier can be varied by altering the length of the resistive ink identifier. In Fig. 2a, the resistive ink identifier 11 follows the shortest possible path between the two contact points 13 and 15. This resistive ink identifier 11 will therefore have a relatively low resistive ~~valve~~ value. In Fig.2b, the resistive ink identifier 17 follows a relatively longer path between the two contact points 19 and 21. This resistive ink identifier 17 will therefore have a higher resistive ~~valve~~ value than the resistive ink identifier 11 of Fig. 2a.

[0035] Resistance may be measured in ohms/square, and resistances range from less than one

ohm/square to thousands of ohms/square. The resistance of an inked path is the product of the squares and the ohms/square. For example, a path of length L may be a total resistance of 1000 ohms. If the path were made twice as long or ½ as wide, the resistance would be 2000 ohms. The resistance would also become 2000 ohms if the ohms/square of the resistive material was doubled. By assigning ink cartridge characteristics to different resistive ~~valves~~ values, the resistive ~~valve~~ value of the resistive identifier can be used to represent those characteristics. For instance, the resistive ~~valve~~ value of the restive ink identifier may be used to access information representative of various physical characteristics of the ink ribbon in the ink cartridge such as the length of the ribbon, the ink density of ink, the ribbon or optimum impact force. Alternatively, a ratio could be assigned between resistive ~~valve~~ value and total ink capacity. In the latter case, the resistive ~~valve~~ value would correspond directly to the ink capacity of the ink cartridge, ~~The~~ the ink capacity could be measured by various means, but would probably be measured by an estimated number of characters that can be printed. As an additional feature, the resistive ink components may be color coded for convenient identification by a human user.

[0038] Fig. 4a illustrates a basic hardware embodiment of the sensor/regulation circuitry 41 of Fig 3. As shown, therein-, a sensor 43 is operative to sense the resistive ~~valve~~ value of the resistive ink identifier. Printer controller 45 is in electrical communication with the sensor 43 and is operative to regulate printing functions, e.g. impact force, in response to the sensed resistive ~~valve~~ value. The printer controller 45 may comprise a simple comparator circuit (not shown) used to translate the sensed resistive ~~valve~~ value into printer control data, if necessary. Display 44 is an electrical communication with the printer controller and operative to display information representative of usage data and the amount of ink left in the ink cartridge.

[0040] When the sensor 43 senses the resistive ~~valve~~ value of the resistive ink identifier, the memory responds to the sensed resistive ~~valve~~ value by correlating the sensed resistive ~~valve~~ value with printer control data in memory. The printer control data thus correlated and/or the corresponding operational routines are sent to the printer controller 45, which regulates printing in response to that input.

[0042] Referring now to Fig. 6, it can be seen how the process of regulating impact force may be accomplished by means of a series of energizations of the coil, or pulses 59a,b,c. Each pulse 59a,b,c has a default pulse width 65 a,b,c, which represent the mount of time for

which the coil is energized. Points 67a,b,c which represents the amount of time for which the coil is energized. Points 67a,b,c which represents the amount of time for which the coil is energized. Points 67a,b,c represent points in time at which the ram reaches the strike point (see Fig. 50). ~~kit~~ it can be seen from the drawing that the pulse width 65a,b,c do not extend ~~fo~~ for ~~th~~ the entire time between the points in time 67a,b,c. In other words, the ram is not normally accelerated during the entire length of its travel to the strike point (see Fig5) Modification of the impact force of the print head, may therefore be, be accomplished by changing the pulse widths 65a,b,c, of the pulses 59a,b,c. For instance, a pulse width addition 69a,b,c may be added to each pulse width 65a,c,b,. For instance, a pulse width addition 69a,b,c, may be added to each pulse width 65 a,b,c. Referring again to Fig 5, in so doing will result~~ing~~ in the ram 53 being accelerated for a greater portion of the time spent traveling in the direction 55 to the strike point 57. The ram 53 will thereby achieve a higher force by the time it reaches the strike point 57, and the connected ~~pion~~ pin of the printer head will therefore strike the document to be printed on with more force (see Fig3). Accordingly, a relatively higher amount of ink will be transferred from the ink ribbon to the document to be printed on.

[0043] Correspondingly, reducing the pulse width will reduce the impact force, and lighten the resulting image. As those skilled in the art will recognize, the broader teachings of the present invention may be utilized not only to identify and implement appropriate printer control functions for an identified printer cartridge. The invention also has application where a user may wish to purposely depart from ~~normanilly~~ normally ~~nonimal~~ nominal printer control functions for a particular purpose. For example, with a mechanical operation of the printer impaired, the user may prefer to implement a higher impact force than would normally be nominal. This can be done by a variety of processes, including removing the resistive label and replacing it with a different label so that results in the application of a higher impact force. As such, the resistive label may serve as a physical variant to control ~~than~~ and to implement different control functions in accordance with predefined operational profiles.

[0044] Fig. 7 illustrates the method of use ~~for~~ of the basic circuitry illustrated in Fig. 4a. First, an ink cartridge is installed into the printer (step 71). When the ink cartridge is so installed, the resistive ~~valve~~ value of its resistive ink identifier is sensed (step 73). The printer controller responds to the sensed resistive ~~valve~~ value by regulating printing (step 75).

In this embodiment, the resistive ~~valve~~ value of the resistive ink identifier could be used, for instance, to represent a relative density of the ink on the ink ribbon of the ink cartridge. If the density was relatively high, the printer controller could respond to the sensed resistive ~~valve~~ value by causing the pins of the print head to strike with less force, i.e. a shorter pulse width. Conversely, if the density was relatively low, the printer controller would respond to the sensed resistive ~~valve~~ value by causing the pins of the print head to strike with more force. Accordingly, a uniform darkness of printed characters would be achieved by the system no matter what type of print cartridge was installed.

[0045] Fig 8 illustrates a basic method of use for the circuitry illustrated in Fig. 4b. As in the previous method, an ink cartridge is installed ~~*~~(step 71) and the resistive ~~valve~~ value of the resistive ink identifier on the ink cartridge is sensed (step 73). However, in this method a memory is used to correlate the sensed resistive ~~valve~~ value with printer control data in the memory (step 77). The correlated printer control data and/or operational routines are input to the printer controller (step 79) which then regulates printing in response to the received input (step 75). ~~Int~~ In ~~his~~ this embodiment, the resistive ~~valve~~ value of the resistive ink identifier maybe be used to represent, for instance, a make or model of the print cartridge. The memory would then include information on ~~an~~ a variety of characteristics of such make and ~~mode~~ model, for instance the length of the ribbon or the density of ink on the ribbon, stored as printer control data. The printer controller would respond to this printer control data and/or corresponding operational routines by regulating printing accordingly. The strike force of the pins on the pin head could be increased or decreased, the rate at which the ribbon was cycled through ~~eh~~ the ink cartridge could be increased, or a number of other functions my be affected.

[0046] Fig. 9 illustrates a method of implementing the invention in relation to the circuitry illustrated in Fig.4b First, the ink cartridge is installed into the printer (step 71). If no ~~valve~~ value is sensed, the printer operates in accordance with default parameters where a resistive ~~valve~~ value of the resistive ink identifier is sensed (step 73), the sensed resistive ~~valve~~ value is correlated to information set in memory (step 81). The information, which may include data and/or operational routines, is used to define and implement a pulse width to be employed when energizing the coils of the striker (see Fig. 5) In response to this information, the printer controller regulates printing (step 75). As printing continues, the ~~valve~~ value is increased (step 83). A counter increments the number of key strokes and that data is used,

e.g. combined with the operational routines, to redefine, e.g. increase the pulse width, or to increase impact force~~,~~. ~~the~~ The redefined pulse width and any other redefined parameters maybe stored in memory (step 81). The result is that 45 the printer prints more and more, the pulse/width impact force increases accordingly and the striker is thereby caused to strike with a gradually increasing amount of force.

[0047] As printing is done, the amount of ink available in an ink cartridge is gradually depleted. However, much ink is remaining in the ink cartridge, it is distributed\, more or less evenly over the ink ribbon. Thus, if less ink is left then the relative density of ink on the ribbon is lower. As a result, in prior art printers, as the ink is depleted the characters printed on a document to be printed grow steadily less dark. Steadily increasing the force with which the striker strikes in accordance with this embodiment of the present invention counteracts with this trend and ensures that the characters printed by the printer continue to be satisfactorily dark.